argon made from Bath gas gave, when the argon was absorbed in charcoal, a gas residuum giving the helium and neon spectrum, and the same result follows the use of atmospheric argon. In the case, however, of the Bath gas argon the helium spectrum is the stronger, whereas with air argon the neon is the most pronounced.

In order to further test the method, the crude gases got by heating the mineral Fergusonite were examined. During the cooling of the charcoal the nitrogen and hydrogen spectra were marked, but in a short time nothing could be seen but the lines of hydrogen and helium.

Great interest will attach to the behaviour of helium, hydrogen and the most volatile part of air, when subjected to the action of charcoal cooled to the temperature of liquid hydrogen. The method promises to open up many avenues for future inquiry.

I am indebted to Mr. Robert Lennox, F.C.S., for efficient assistance in the conduct of the experiments, and Mr. J. W. Heath, F.C.S., has also helped me in the investigation.

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"On the Action of Wood on a Photographic Plate in the Dark." By WILLIAM J. RUSSELL, Ph.D., F.R.S. Received May 28.—Read June 16, 1904.

(Abstract.)

[PLATE 7.]

It has been shown in former papers that many substances are capable of acting on a photographic plate in the dark and producing a picture of themselves. Further investigation shows that this property belongs probably to all woods, some, however, being much more active than others.

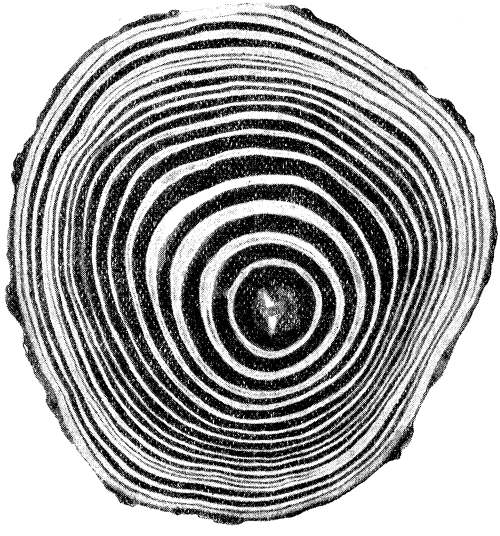
To obtain a picture the wood has to be in contact or at a little distance above the photographic plate, and has to remain there for times varying from ½ an hour to 18 hours, and to be at a temperature not higher than 55° C.

The wood of the conifers is very active, and gives pictures which are very definite. Fig. 1 is a picture of a section of a branch of a Scotch fir, and shows well the rings of spring and autumn growth. It is remarkable that the former are very active, producing in this picture the dark rings, and so with the other pictures, the part which is active in the original is dark in the picture. The rings seen in the wood are very sharp and strongly pronounced in the picture. If the action exerted on the plate be owing to the presence of hydrogen peroxide, as has been previously suggested, no doubt it is produced

by the resinous bodies present in the wood, but it is remarkable that there is no action from the dark autumn wood. Experiments described in the full paper show that resin exists in the dark rings, but apparently under such conditions that it cannot escape. Other members of the pine group have been experimented with and have been found to behave in the same way as the Scotch fir.

With the spruces the action on the plate is not so definite and well marked; the white wood is always active, but in some cases the dark rings are also active, and the pictures are not so sharp as with the firs. Larch wood gives a very interesting result, for the picture is

FIG. 1.



the reverse of that of the Scotch fir, that is, the dark rings in the wood are the active rings and the light rings are inactive.

With regard to woods other than conifers, oak and beech are both active and give very good pictures, so also does acacia (*Robinia*), Spanish chestnut, and sycamore; on the other hand, ash, elm, horse chestnut, plane are comparatively but slightly active. In the full paper lists of woods are arranged according to their activity.

Many foreign woods are very active, but as the annual rings are often not well developed, the pictures they give are of a somewhat different character. The African black wood, rose wood, cocobola, and many others are very active. Several of the foreign woods have a ring of white wood which is quite inactive.

Knots in a wood generally, but not always, give a good picture.

Some of the resin in immediate contact with the knot is in some cases but little active. The marked difference in properties of resins from different sources is described, and it is shown how difficult it is to remove it, so that the wood shall be no longer active. Boards that have been exposed to the air for a long time, an oak box a hundred or more years old, rotten wood from the stump of a tree, and even bog wood have all been found to be still active.

In addition to woods many different resins and allied bodies can, when used alone, be proved to be very active, some naturally much more so than others. Ordinary resins, Burgundy pitch, gum mastic, are very active, asphaltum, dragons blood much less so, but true gums such as gum senegal and gum arabic are entirely without action on a photographic plate.

In certain cases the picture obtained on the plate does not resemble the markings which are visible on the wood. With some woods this more commonly occurs than with others. That this picture is persistent in the wood is shown by fresh sections giving the same result. The true bark of a wood is apparently quite without action on a photographic plate, so is the internal pith of a plant.

There is another and a very interesting action, which occurs with wood, it is the great increase of activity which it exerts on a photographic plate after it has been exposed to a strong light. For instance, if a piece of deal be half covered by black paper or tin foil and be exposed for 5—10 minutes to bright sunlight, and then put up in the usual way with a photographic plate, it will give a dark picture where the light has fallen on the wood and only a very faint picture of the part which has been covered. This is shown in Plate 7, fig. 1. Even comparatively inactive woods such as elm and ivy after a short exposure to bright light give good and dark pictures. The action is not an indiscriminate darkening over the whole wood section, but an intensifying of the parts already active. This increase of activity by the action of light appears to occur with all woods. Artificial light, such as that from the electric arc, or from burning magnesium ribbon, act in the same way, so does even a faint light. A piece of wood put at a window for some hours will give a darker picture than a similar piece left in the middle of the room. This increase of power of a wood to produce a picture does not rapidly pass away. After 24 hours the action is visibly less, and decreases more rapidly at first than after some days, but it will be a fortnight or may be a month before the wood resumes its former condition. This action, like the former one, is entirely stopped by interposing the thinnest piece of glass or mica between the photographic plate and the active body. An inactive card painted with an alcoholic solution of resin, acts in the same way, and turpentine which has been exposed to a bright light acts more strongly on a photographic plate than it

does when it has not been so exposed. Again, old printing which is now nearly inactive becomes much more active after exposure to sunlight. Bodies other than those which may contain resin or allied substances are not affected in this way by light, for instance, flour, sugar, porcelain ; metals are not rendered active by sunlight.

The next point was to ascertain which of the constituents of light was most active in producing these effects, and the first experiments were made by simply placing strips of different coloured glass on wood sections, exposing them to sunlight and afterwards putting them up with the photographic plate in the usual way. Pictures of the results are given in the paper. Red glass entirely prevented any increase in the activity of the wood, in fact, it acted in the same way as a band of black paper or tin foil would act, and a green glass acted much in the same way, but under a blue glass the activity of the wood was increased to much the same extent as under colourless glass or under no glass. Plate 7, fig. 2, shows what happens when a red glass and a white glass are placed upon it and exposed to sunlight. On the right of the figure there was no glass.

Further experiments were made by placing similar pieces of deal in light which had passed through different coloured solutions. Three double-cased bell jars were taken, one was charged with a solution of potassium bichromate, another with copper ammonium sulphate solution, and the third with pure water, and all were exposed to sunlight for 4 hours. The deal in the red light gave only a faint picture, that in the blue light a dark picture, and that with the pure water was only a slightly darker picture. Resin, guiacum, copal varnish, white oil paint and resin sized paper all acted in the same way and gave similar results.

The light from an arc lamp when passed through a red glass and allowed to fall on a wood section for $1\frac{1}{2}$ hours produced no effect, but when the same light was passed through a blue glass and fell on a similar wood section for only 1 hour it produced a dark picture. With liquids this same increase of activity by the action of blue light is produced. Turpentine, which has been exposed to blue light, is more active than when in its ordinary condition.

FIG. 1.

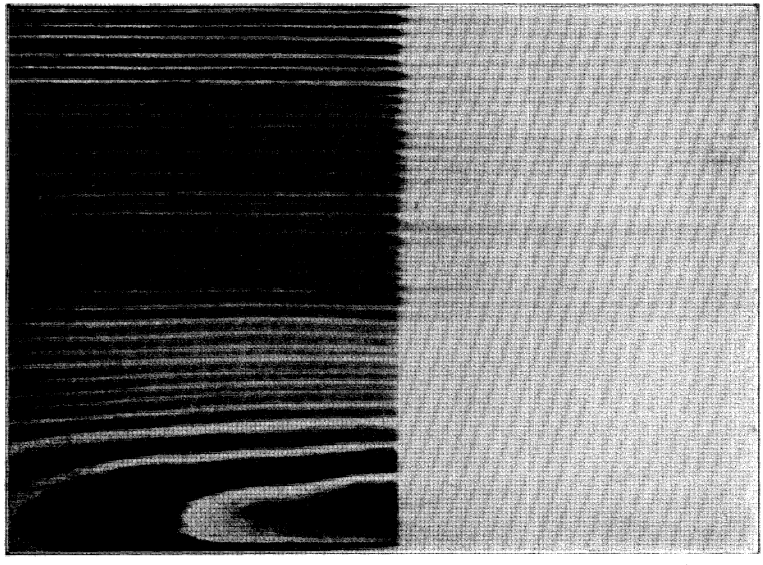


FIG. 2.

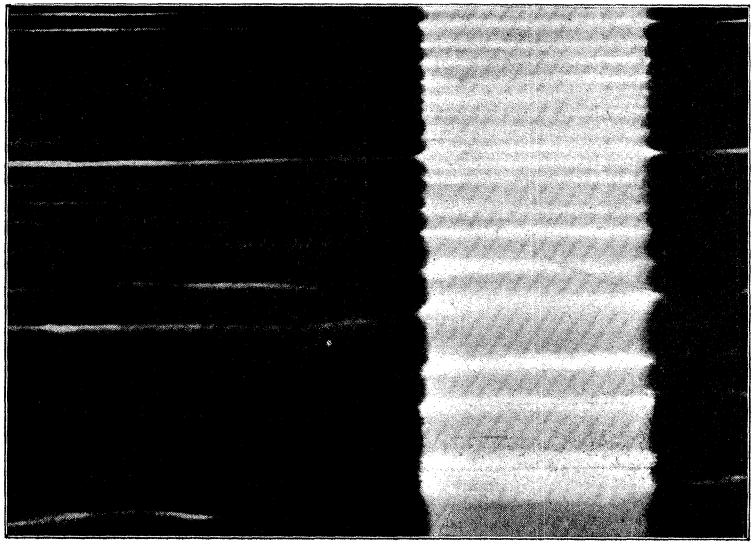


FIG. 1.

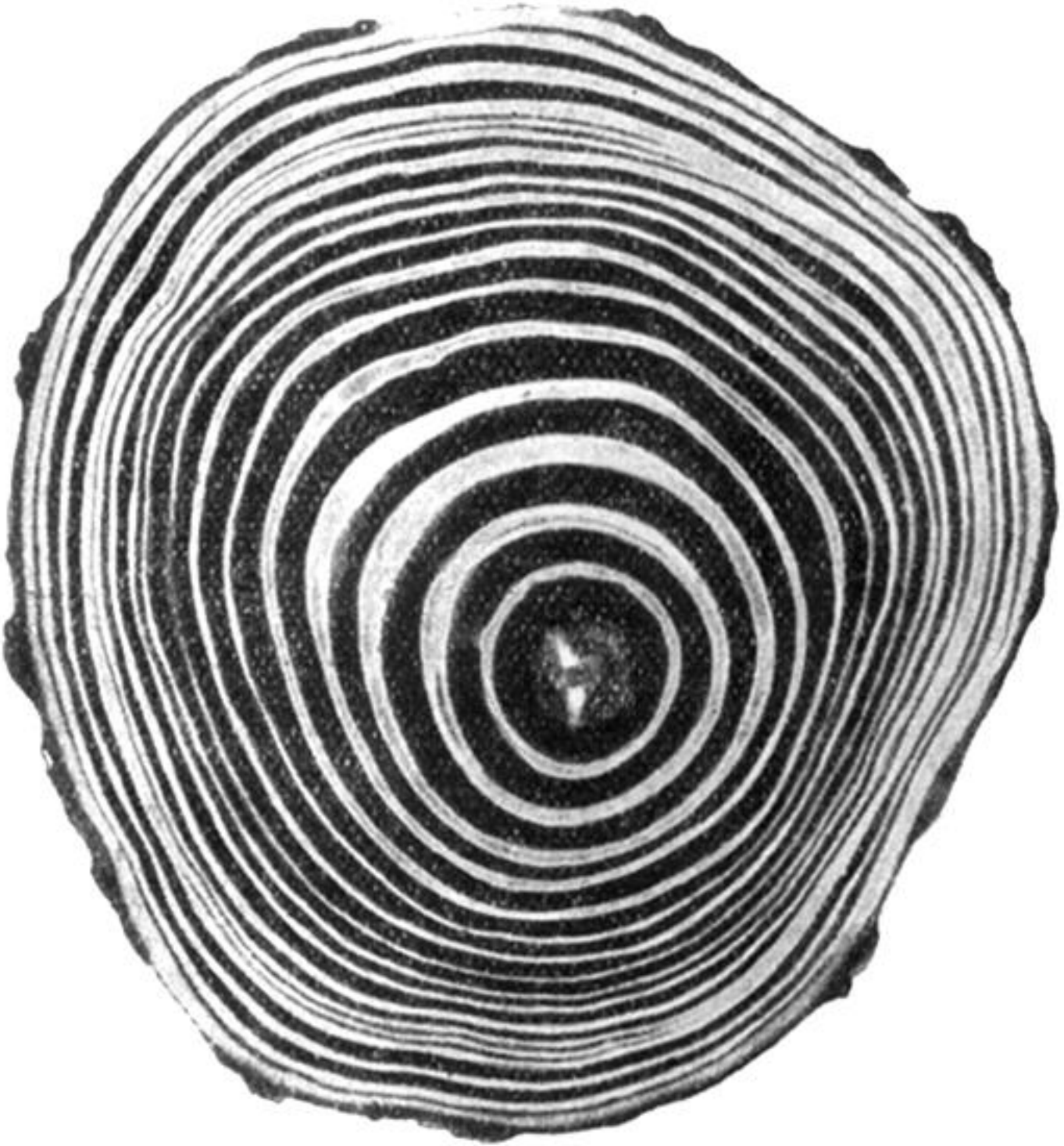


FIG. 1.

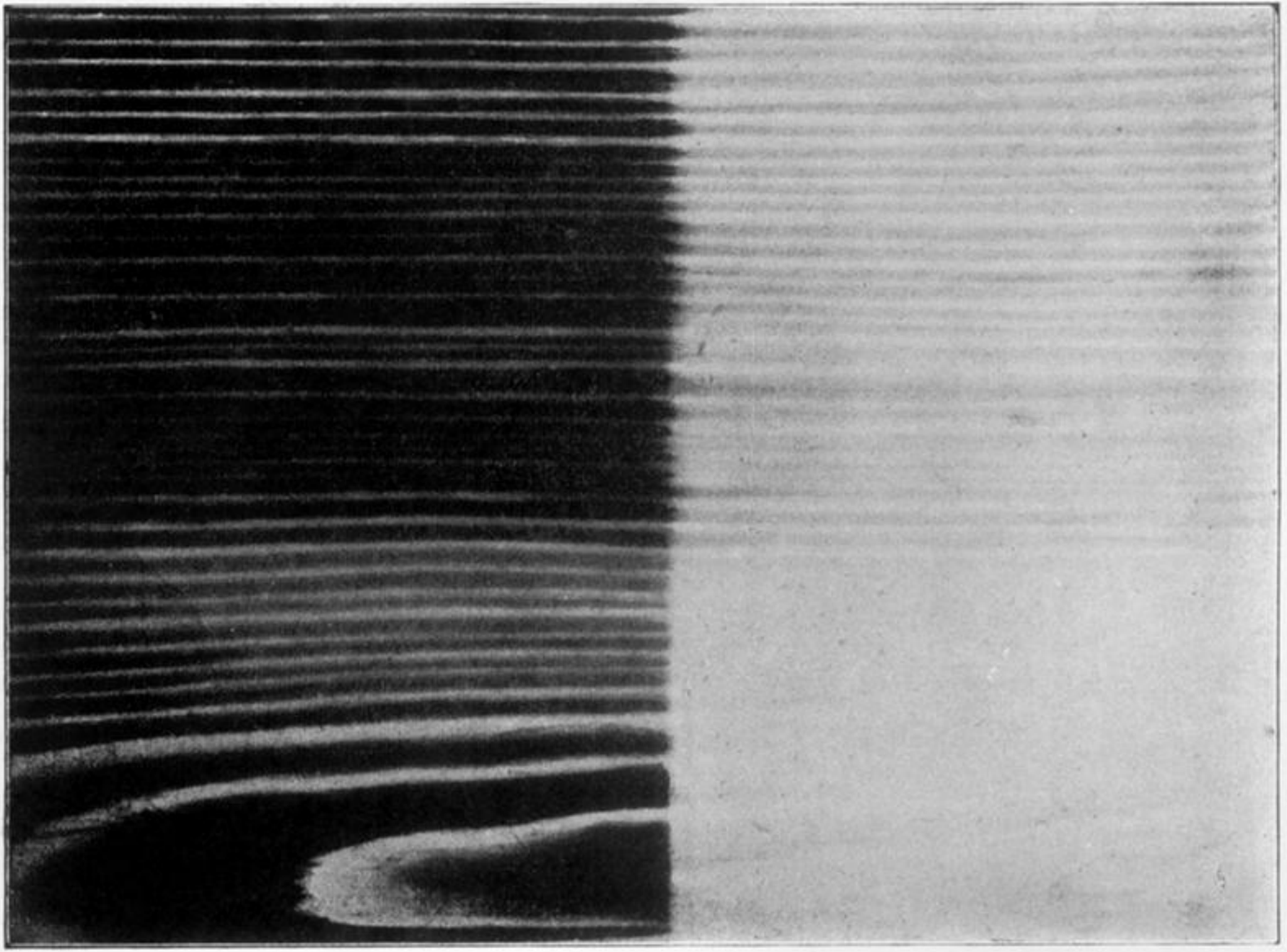


FIG. 2.